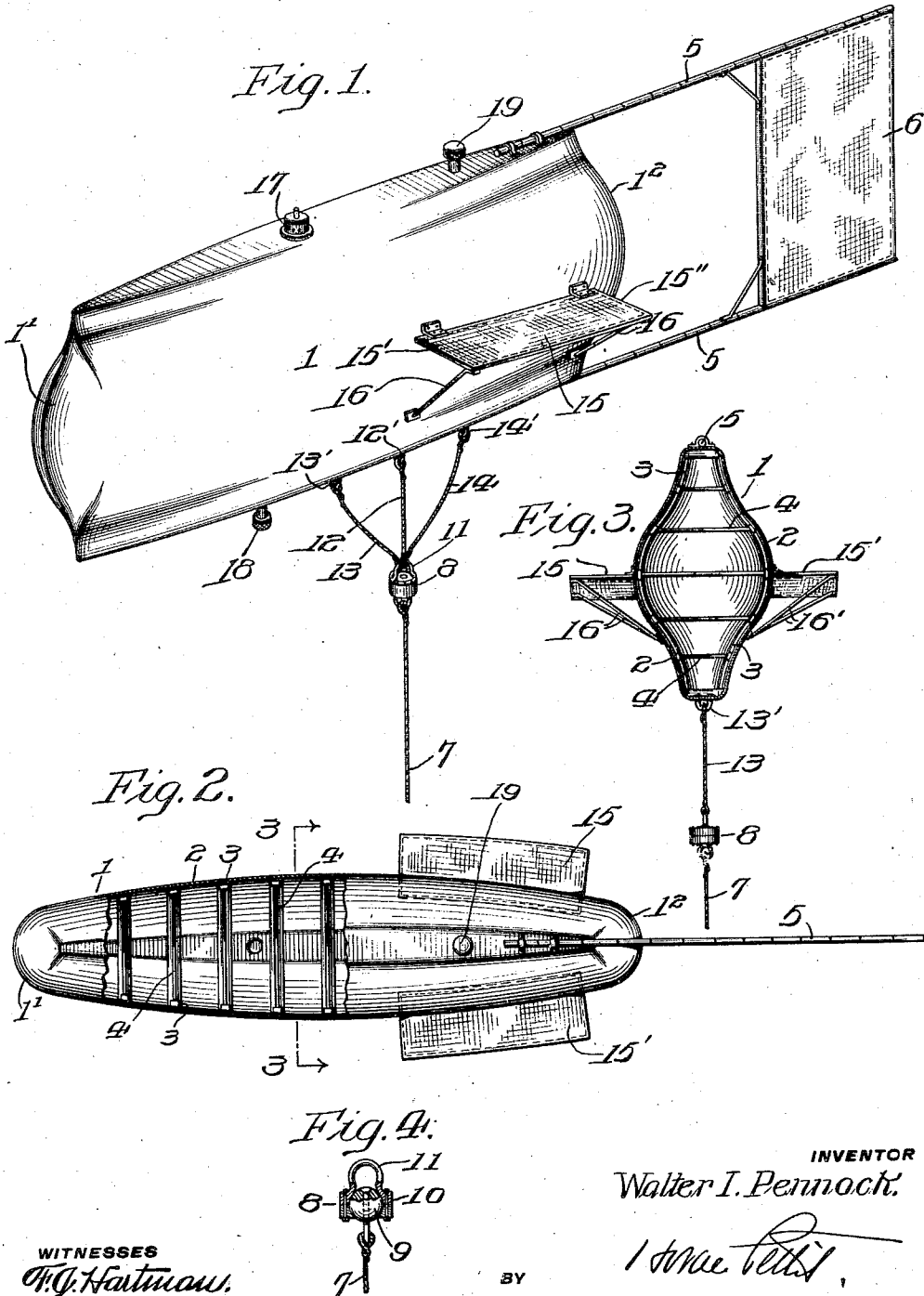


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CAPTIVE BALLOON.  
APPLICATION FILED AUG. 9, 1910.

1,005,871.

Patented Oct. 17, 1911.



WITNESSES  
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# UNITED STATES PATENT OFFICE.

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## CAPTIVE BALLOON.

1,005,871.

Specification of Letters Patent.

Patented Oct. 17, 1911.

Application filed August 9, 1910. Serial No. 576,414.

*To all whom it may concern:*

Be it known that I, WALTER I. PENNOCK, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in Captive Balloons, of which the following is a full, clear, and exact disclosure.

My invention relates to captive balloons, and particularly to such balloons as may be used for elevating collectors of atmospheric electricity from the high altitudes of the earth's atmosphere, and it relates to the construction and arrangement of the parts and shape of the balloon body or envelop.

The objects of my invention are, the providing of the balloon with an envelop or gas container, which is elongated in shape and which will freely turn in the air as it may be acted upon by the wind or air currents; to keep the end of the balloon or envelop which is of least transverse cross sectional area toward the direction from which the wind is blowing; to provide the balloon or gas container with a stationary vane or rudder, by means of which the forward and smaller end of the balloon is kept against the wind; to provide the envelop with side wings or planes, so arranged as to assist in elevating the balloon to high altitudes, and to utilize the force of the wind or air currents in lifting the balloon; to provide a means whereby the elongated envelop or gas container is maintained in a substantially fixed plane, with the forward end elevated a little above the level of the rear end, so that the side wings or planes may have a kite effect and lift the rear end of the gas container or envelop, should it tend to drop; to attach the anchor line or stay to the bottom of the balloon or gas container in such a manner that the forward end of the balloon will always be kept at a little higher level than the rear end, and to further provide means whereby the point of the virtual attachment of the stay or anchor line to the bottom of the balloon may be shifted forwardly or rearwardly whenever the balloon substantially deviates from its normal position; to swivel the balloon to the anchor line or stay so that the balloon will turn as the wind may change without being required to twist the whole

length of the anchor line; and to make the envelop or gas container of a suitable, thin, metallic material, so that it may act as a collector of atmospheric electricity and to conduct the electricity which may collect upon the envelop or gas container to the earth, to be used for any useful purpose.

Other objects of my invention will appear in the specification and claim below.

Referring to the drawings forming a part of this specification, in which the same reference numerals are used to designate the same part throughout the various views, Figure 1 is a perspective view of one embodiment of my invention; Fig. 2 a top plan view of the same, the forward part of the envelop being broken away to show the interior construction; Fig. 3 is a vertical transverse cross sectional view on the line 3—3 of Fig. 2; and Fig. 4 is a detail of the swivel joint, by means of which the balloon is attached to the stay or anchor line.

The balloon body or gas container or envelop, 1, is elongated in shape, having its largest dimensions substantially midway between its ends, from which point the body or envelop gradually tapers forwardly and rearwardly to form relatively narrow ends of small transverse area. The forward and rear ends 1' and 1<sup>2</sup>, respectively, are preferably slightly bulged and rounded, so as not to present an absolutely sharp edge to the wind, to give space for the gas to be contained in the envelop, and to prevent the end of the envelop from being flattened or bent inwardly by the action of the wind. I also prefer to make the bottom and top edges of the balloon narrow, so that the sides of the balloon widen out from the top and bottom as they approach the horizontal, longitudinal, diametrical plane of the balloon or gas container, at which point the width of the envelop is greatest.

The body or envelop 1 may be constructed of any suitable material, but I prefer to make the shell 2 of very thin, tough steel, stiffened as may be necessary by substantially vertically arranged angle iron ribs 3, and suitable cross bars 4 reaching from side to side of the envelop and engaging with the ribs 3. At the rear ends of the top and bottom sides of the body or gas envelop 1, I secure light rods 5—5, of bamboo or other suitable light strong material, the said rods

extending outwardly from the rear end of the body 1 for such a distance as may be found necessary, and I stretch a light tough fabric between the said rods 5—5 to form a vane or rudder 6.

The end of the stay or anchor line 7 is provided with a suitable swiveled joint 8, which may consist, and preferably does, of a ball and socket construction. In the form shown in Fig. 4 of the drawings, the ball 9 is secured to the stay or anchor line 7, and surrounding and inclosing the ball 9 is a socket 10 provided with a loop or eye 11. In using this swiveled joint 8 in connection with my improved captive balloon, the main cord or line 12 is attached to the loop or eye 11 at its lower end, and to the bottom of the balloon or gas container 1 at the point 12'. This point 12' is so positioned with respect to the whole balloon, that in a still atmosphere the forward end 1' of the gas container is at a little higher level than the rear end 1<sup>2</sup>. To do this the point 12' would generally be slightly to the rear of the middle of the gas container; at least it is to the rear of a vertical plane passing through the center of buoyancy of the balloon when the balloon is in a horizontal position. From the eye 11 also run secondary or supplemental cords 13 and 14 attached to the bottom of the gas container as at points 13' and 14', the former forwardly of, and the latter to the rear of the point 12'. The length of the cords 13 and 14 is such that when the balloon or gas container is in its normal position, the cords 13 and 14 will be slack. When, therefore, one end of the balloon, as, for instance, the rear end, tends to swing downwardly about the point 12' as a center, tension will immediately be put upon the cord 13, thus virtually making the point of attachment of the stay or anchor line 7 to the bottom of the balloon or gas container intermediate of the points 12' and 13'. As these points 13' and 14' are on opposite sides of a line passing through the center of gravity or the center of buoyancy of the balloon, the gas in the rear end of the balloon will immediately tend to lift that end about this new point of virtual attachment of the stay or anchor line 7 with the bottom of the balloon or gas container, and the balloon will immediately come to its normal position. The converse is true whenever the forward end of the balloon dips downwardly. Tension is immediately put upon the cord 14; the point of the virtual attachment of the cord 7 immediately shifts to a point somewhere between 12' and 14' and the gas in the forward end of the balloon will lift that end until the gas container re-assumes its normal position. To further steady the balloon body or gas container 1, and to assist in elevating the same, I provide side or laterally extending wings or planes

15 and 15', stationary with respect to the envelop or gas container 1, and rigidly secured to the sides thereof, preferably to the ribs 3 through the shell 2. These wings or planes 15 and 15' are suitably braced by braces 16 and 16', and are set relatively to the gas container or envelop 1 so that when said envelop is in its normal position, the forward ends of the wings or planes 15 and 15' will be higher than the rear ends of the same. When the wind is blowing against the forward end of the balloon, as it passes the body it strikes upon the end sides of the wings or planes 15 and 15', and exerts a lifting effect upon the whole balloon in the same manner as a kite exerts a lifting pull when similarly inclined.

From the above description it will be plain that the whole balloon or gas envelop, with its attached vanes and wings, will be maintained in the air with its forward end slightly higher than its rear end, and with its forward end always turned toward the direction from which the wind is blowing, by reason of the action of the stationary rudder or vane 6 and the swiveled connection 8 between the body or gas envelop 1 and the stay or anchor line 7. It will also be seen that the body will tend to be always maintained in this slightly inclined position, and that should one end or the other end of the gas container or body 1 drop or lift so as to turn the body in a vertical plane around the point 12' as a center, tension will immediately be put on the cord 13 or 14, depending upon which direction the balloon turns, and the balloon will be righted and brought to its normal position by a shifting of the virtual point of attachment of the cord 7 with the bottom of the balloon.

Any suitable metal may be used in constructing the balloon, although thin steel appears to me to be the best material for the same, inasmuch as it can be made very thin and its tensile strength is very high. The ribs and cross bars 3 and 4, respectively, may be made of thin steel, aluminum or wood, and the rudder 6 and wings 15 and 15' may be made of thin, tough silk, oiled or otherwise treated so that the same will not absorb moisture.

Inasmuch as the pressure of the gas contained within the body or envelop 1 will expand as the atmosphere in which the balloon is suspended grows rarer, I provide a safety valve 17 of any approved type which may relieve the interior of the balloon of pressure when the pressure within the gas container or envelop 1 becomes so great as to be liable to burst the container or envelop.

In order to fill the envelop or gas container 1 with gas, I prefer to fill the envelop first with water and to then displace the water with hydrogen gas, as, for instance, by allowing the water to escape through the

valve 18, the water as it runs out drawing in the hydrogen gas, as through the valve 19 at the top of the envelop.

When the envelop is made of a suitable metal, such as steel or copper, the same may be used as a collector of atmospheric electricity, and to conduct the electricity so collected upon the envelop 1 to the earth, where it may be used as desired, I prefer to either incorporate into the anchor line 7 and the cord or line 12 a copper wire, or to wrap said wire around said anchor line 7 and cord 12, and to secure the upper end of said wire to the metallic covering of the balloon or gas container 1. This wire is indicated diagrammatically by the line 20.

Although I have described but one embodiment of my invention, it is to be understood that other forms and modifications are fully contemplated by me, so long as the structure thereof falls within the scope of the appended claim.

Having thus described my invention, what I claim and desire to protect by Letters Patent of the United States, is:

The combination of an elongated longitudinally rigid balloon, and a stationary rudder secured to the rear end thereof, with an anchor line secured to said balloon wholly to the rear of the center of buoyancy thereof, laterally projecting rearwardly positioned and angularly elevated planes secured to said balloon, and a pair of slack auxiliary lines secured to said anchor line and to said balloon on opposite sides of said anchor line, the whole cooperating to increase the vertical stability of the balloon.

In witness whereof, I have hereunto set my hand this 6th day of August, A. D., 1910.

WALTER I. PENNOCK.

Witnesses:

H. N. DORITY,  
LAURA EVANS LALOR.